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DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS

RST-07551R (March 2002)

Superseding
RST-07551R (August 2000)
CEGS-07551 (January 1998)
CEGS-07535 (June 1995)

GUIDE SPECIFICATION FOR MILITARY CONSTRUCTION

Specification revised to meet U.S. Army Reserve requirements (August 2000)

Includes changes through Notice 1 (September 1998)
Includes Special Change (Submittal Paragraph)(June 2000)

Latest change indicated by CHG tags

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07551R

MODIFIED BITUMEN ROOFING

03/02

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SECTION 07551R

MODIFIED BITUMEN ROOFING
03/02

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NOTE: This guide specification covers the requirements for modified bitumen roofing. This guide specification is to be used in the preparation of project specifications in accordance with ER 1110-1-8155.

NOTE: RST-07551 is a Louisville District Army Reserve Support Team (RST) version of CEGS-07551. Any text changed by the RST is underlined. Refer all specification comments to the RST.

****

PART 1 GENERAL

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NOTE: Except when placed on potentially wet substrates such as gypsum and insulating concrete (that require mechanical fastening to permit venting), modified bitumen membranes should be fully adhered, and may be used in protected membrane systems.

Where roof slopes are greater than 42 mm/m (1/2 inch per foot) the use of mechanical fastening will be required and this section will be revised accordingly. Roof slopes will be determined by environmental conditions and local experience, but in no case shall roof slopes be less than 21 mm/m

(1/4 inch per foot). To the greatest extent practicable, roof slopes should be obtained by sloping the structural members in lieu of the use of moisture-bearing lightweight fills, asphaltic dry fills, or tapered board-type insulations. Direction and degree of slope should be indicated on the roof plan.

Roofing manufacturers and pertinent data published by Factory Mutual will be consulted for recommendations on attachment recommendations in areas where high winds have caused roof damage.

Expansion joints in the roofing should be provided at each expansion joint in the structure. Area dividers should be provided: (a) at uniformly spaced intervals not over 60 m (200 feet) in length or width; (b) at each intersection where an "L" or "T" shaped roof deck changes direction, (c) at each change of deck material.

Expansion joints should be located at high points, where practicable, and should be placed on curbs above the water line.

Structural concrete and lightweight insulating concrete should be capable of drying downward into the building.

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1.1 REFERENCES

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NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest change (Notice) to this guide specification.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208	(1995) Cellulosic Fiber Insulating Board
ASTM C 1153	(1997) Location of Wet Insulation in Roofing Systems Using Infrared Imaging
ASTM D 41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 312	(1995a) Asphalt Used in Roofing

ASTM D 517	(1992) Asphalt Plank
ASTM D 1863	(1993; R 1996) Mineral Aggregate Used on Built-Up Roofs
ASTM D 2824	(1994) Aluminum-Pigmented Asphalt Roof Coatings, Non-Fibered, Asbestos Fibered, and Fibered without Asbestos
ASTM D 3746	(1985; R 1996) Impact Resistance of Bituminous Roofing Systems
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free
ASTM D 4601	(1997) Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D 4897	(1997) Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM D 5147	(1997) Sampling and Testing Modified Bituminous Sheet Material

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825c	(1998) Approval Guide Building Materials

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(1998) Building Materials Directory
UL 790	(1997) Tests for Fire Resistance of Roof Covering Materials
UL 1256	(1998) Fire Test of Roof Deck Constructions

1.2 SYSTEM DESCRIPTION

The modified bitumen roofing system shall consist of a manufacturer's standard, prefabricated, reinforced polymer-modified bitumen membrane, with base sheet, and insulation as specified and indicated. The manufacturer shall have a minimum of 5 years experience in manufacturing of the proposed modified bitumen sheet roofing for similar applications.

1.3 SUBMITTALS

****

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

Indicate submittal classification in the blank space following the name of the item requiring the submittal by using "G" when the submittal requires Government approval. Submittals not classified as "G" will show on the submittal register as "Information Only". For submittals requiring Government approval, a code of up to three characters should be used following the "G" designation to indicate the approving authority; codes of "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval are recommended.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Acceptable Manufacturer Products; FIO

****

NOTE: Vendor information that forms part of this guide specification is permissible to use as long as the salient features provide for "or equal" product equivalents are specified. Submittal clauses must be modified to make known that specific vendor information is being specified. If the Contractor chooses to provide the specified vendor's product, the submittal for that item is considered a For Information Only submittal. If the Contractor uses a different "or equal" item, then it will be evaluated against the salient features. Hence, it is considered for Government Approval (G).

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Manufacturers products listed in this specification are referenced to establish a standard of quality. When the specific product listed is submitted by the Contractor, that submittal will be considered For Information Only. When an equal to that named in this specification is submitted, it shall be for Government Approval (G). The following manufacturer products are specifically mentioned in this specification:

Johns Manville Roofing System Group; FIO
717 17th Street
Denver, CO. 80202
800-654-3103

GAF Materials Corporation; FIO
1361 Alps Road

Wayne, NJ 07470
214-580-5600

Simplast
Suite 1600N
222 West Los Colinas Blvd.
Irving, Texas 75039
972-869-0070

Modified Bitumen Roof Manuf. Product submitted as an "or equal"; G [___].

SD-07 Certificates

Qualifications; FIO

Evidence that the manufacturer has a minimum of 5 years experience manufacturing modified bitumen roofing. The roofing system applicator shall be approved by the modified bitumen roofing manufacturer, and shall have a minimum of 3 years experience as an approved applicator. A list of installations using the same products and applicator as proposed shall be included.

Materials; FIO

Certificates of compliance for felts, bitumens, and membrane sheet.

SD-08 Manufacturer's Instructions

Materials and Installation; FIO

Manufacturer's instructions, including membrane description and performance data, detailed procedure for installation, and safety precautions, prior to the start of roofing work.

SD-13 Records; FIO

Bills of Lading; FIO

Bills of lading shall indicate the flash point and equiviscous temperature (EVT) and this information shall be shown on labels for each unit (or plug) of asphalt.

1.4 STORAGE OF MATERIALS

Felts and roofing sheets shall be kept dry before, during, and after delivery to the site. Felts and roofing sheets shall be stored on end one level high, in an enclosed building or trailer and on platforms, off the deck or floor. Felts and sheets shall be maintained at a temperature above 10 degrees C 50 degrees F for 24 hours immediately before laying.

1.5 COORDINATION REQUIREMENTS

The work shall be coordinated with other trades to ensure that components

are available when they are to be secured or stripped into the roofing system.

1.5.1 Insulation Application

Application of roofing shall immediately follow application of insulation as a continuous operation.

1.5.2 Flashing

Modified bituminous sheet shall be used for flashings where the roof deck abuts angles, vertical surfaces, edge metal, and penetrations, unless otherwise specified or indicated. Flashing shall be installed as the work progresses.

1.5.3 Sheet Metalwork

Sheet metalwork specified in Section 07600 SHEET METALWORK, GENERAL shall be coordinated with roofing operations.

1.6 ENVIRONMENTAL CONDITIONS

****
NOTE: Select the first bracketed sentence except in cold climates.
****

[Air temperature shall be above 4 degrees C 40 degrees F and there shall be no visible ice, frost, or moisture on the roof deck at the time roofing is installed.] [Roofing shall not be applied when air temperature is less than minus 7 degrees C. 20 degrees F. When air temperature is less than 4 degrees C, 40 degrees F, kettles shall be insulated, felts and sheets shall be kept warm, and the application site shall be protected.]

1.7 FLAME HEATED EQUIPMENT

****
NOTE: Where torches are not permitted on the roof, delete references to torch application.
****

Flame heated kettles shall not be placed on the roof. Torch application shall be approved by the membrane manufacturer for the specific modified bitumen. Open flame equipment shall not be left unattended while ignited.

1.8 ELECTRIC-HEATED EQUIPMENT

Adequate electrical service shall be provided as required by the manufacturer of the equipment, to insure proper application of the roofing materials.

1.9 FIRE AND WIND UPLIFT REQUIREMENTS

****

NOTE: Modified bitumen roofing over a metal deck must have either a UL 1256 classification or an FM Class I listing in addition to UL 790. Wind uplift requirement must be determined for local conditions.

****

[The complete roof system shall have a [UL 1256,] [UL 790, Class A or B classification], be listed as "fire classified" in UL Bld Mat Dir, and bear the UL label or be listed as a Class I Roof Deck in FM P7825c.] [Roofing system over steel deck shall be rated Class I- [60] [90] [105] [120] [_____] in accordance with FM P7825c.] Ratings from other independent laboratories may be substituted provided that the tests, requirements and ratings are documented to be equivalent, to the satisfaction of the Contracting Officer.

1.10 WARRANTY

****

NOTE: Although a warranty does not prevent problems, reputable manufacturers will issue a warranty if the installation is applied by an approved applicator.

****

Manufacturer's standard warranty for the roofing system shall be provided for not less than [10] [_____] years from acceptance of the work. Warranty shall state that manufacturer shall repair or replace defective materials if the roofing system leaks or allows the insulation beneath the membrane to become wet during the period of the warranty.

PART 2 PRODUCTS

2.1 PRIMER

Primer shall conform to ASTM D 41.

2.2 ASPHALT

Asphalt shall conform to ASTM D 312, Type III for slopes up to 25 percent (1/4 vertical/horizontal) and Type IV for slopes up to 50 percent (1/2 vertical/horizontal).

2.3 BITUMINOUS CEMENT

Bituminous cement shall conform to ASTM D 4586.

2.4 CANTS AND WOOD NAILERS

Treated wood cants and wood nailers shall be of water-borne preservative-treated material as specified in Section 06100 ROUGH CARPENTRY. Cants shall be made from treated wood or treated fiberboard not less than 89 mm 3-1/2 inches high and cut to reduce change in direction of the membrane to 45 degrees or less. Fiberboard shall conform to ASTM C 208, treated with sizing, wax or bituminous impregnation. When membrane or

flashing is to be torch applied, cants shall be fire resistant.

2.5 BASE SHEET

****
NOTE: Specify venting base sheet over gypsum and light weight or insulating concrete, with or without insulation.
****

[Venting inorganic felt base sheet shall conform to ASTM D 4897, Type II.]
[Non venting base sheet shall conform to ASTM D 4601, Type II.]

2.6 MODIFIED BITUMEN SHEET

****
NOTE: See the note in PART 1 GENERAL for restrictions on climate and installation methods, and delete the inapplicable modified bitumen. Specify the protective surfacing or plain surface.

Delete APP modified bitumen sheet where torch application is prohibited.

In cold climates, reduce the low temperature flexibility to the winter design temperature found in TM 5-785, except that the flexibility temperature will not be colder than minus 43 degrees C (minus 45 degrees F).
****

Modified bitumen sheet shall be a bitumen modified by [atactic polypropylene (APP)] [or] [styrene butadiene styrene (SBS); or modified by SBS which has been further modified with styrene ethylene butadiene styrene (SEBS)]. Sheets shall be uniform in thickness and appearance, and free from blisters or tape splices. Sheets shall not stick to the roll or stack, and shall be suitable for joining along the entire length by the procedure recommended by the manufacturer. Sheet shall be reinforced with fiber made from glass, polypropylene, or polyester, and shall meet the following requirements:

MODIFIED BITUMEN SHEET PROPERTIES

Maximum Load/Elongation, ASTM D 5147, weakest (longitudinal or transverse) direction:

Maximum load, minimum	15 KN/m
Elongation, minimum; when reinforced with:	
glass fiber	3 percent
polyester or polypropylene	40 percent

Tear Strength, ASTM D 5147
Minimum 356 N

MODIFIED BITUMEN SHEET PROPERTIES

Low Temperature Flexibility, ASTM D 5147	[SBS: minus 26 degrees C] [APP: minus 9.4 degrees C] [_____]
Impact Resistance, ASTM D 3746	No Damage

MODIFIED BITUMEN SHEET PROPERTIES

Maximum Load/Elongation, ASTM D 5147 weakest (longitudinal or transverse) direction:	
Maximum load, minimum	90 lbf/in.
Elongation, minimum, when reinforced with:	
glass fiber	3 percent
polyester or polypropylene	40 percent
Tear Strength, ASTM D 5147	
Minimum	80 pounds
Low Temperature Flexibility, ASTM D 5147	[SBS: minus 15 degrees F] [APP: plus 15 degrees F] [_____]
Impact Resistance, ASTM D 3746	No Damage

2.7 NAILS AND FASTENERS

Nails and fasteners shall be an approved type recommended by the roofing felt or membrane manufacturer.

2.8 SURFACING MATERIAL

****

NOTE: When available at reasonable cost, use light-colored aggregate to conserve energy and extend the life of the membrane. Select the surfacing material required, and delete inapplicable sentence.

****

Surfacing shall be [light colored, opaque, crushed stone or gravel conforming to ASTM D 1863] [factory applied granules requiring no further coating].

2.9 ADHESIVE

Adhesive shall be an approved type recommended by the membrane manufacturer.

2.10 WALKWAY SURFACES

Walkway surfaces shall be [mineral surfaced modified bitumen cap sheet as recommended by the membrane manufacturer,] [mineral asphalt plank, ASTM D 517, minimum 19 mm 3/4 inch thick,] [concrete pavers, [200 x 400 mm 8 x 16

inches] [size as indicated], 38 mm 1-1/2 inchminimum thickness, and made from 20.68 MPa 3000 psi air entrained concrete per Section 02770 CONCRETE SIDEWALKS AND CURBS AND GUTTERS,] [metal grid walkways as specified in Section 05500 MISCELLANEOUS METAL] [_____].

2.11 INSULATION

Insulation shall be compatible with the membrane, as recommended by the membrane manufacturer's printed instructions, and as specified in Section 07220 ROOF INSULATION.

2.12 COATING

Aluminum coating shall conform to ASTM D 2824 Type I or III, or shall be as recommended by the membrane manufacturer.

PART 3 EXECUTION

3.1 PREPARATION REQUIREMENTS

The substrate construction of any bay or section of the building shall be completed before roofing work is begun thereon. [Roofing applied directly on lightweight insulating concrete shall not be scheduled until the insulating concrete passes the air-dry density test specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.] [Roofing applied directly on concrete shall not be scheduled until hot bitumen sticks tightly and does not froth or bubble when applied to the concrete.] Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Nailers, curbs and other items attached to roof surface shall be in place before roofing is begun.

3.2 INSTALLATION OF CANTS

Cants shall be installed in the angles formed between the roof and walls or other vertical surfaces. Cants shall be laid in a solid coat of bituminous cement just prior to laying the base sheet or membrane. Cants shall be continuous, and shall be installed in lengths as long as practicable.

3.3 CONDITION OF SURFACES

Surfaces shall be inspected and approved immediately prior to application of roofing and flashings. The roofing and flashings shall be applied to a smooth and firm surface free from ice, frost, visible moisture, dirt, projections, and foreign materials. Prior to application of primer on precast concrete decks, joints shall be covered with a 100 mm 4 inch strip of roofing felt, embedded in and coated with bituminous cement. Modified bitumen membrane shall be isolated from coal tar pitch.

3.4 MECHANICAL APPLICATION DEVICES

Mechanical application devices shall be mounted on pneumatic-tired wheels, and shall be designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

3.5 PRIMING

Concrete, masonry and metal surfaces to receive bitumen shall be uniformly coated with primer at a rate of not less than 0.4 liter per square meter 1 gallon per square and allowed to dry.

3.6 HEATING OF BITUMEN

Asphalt shall not be heated higher than 42 degrees C 75 degrees F above the EVT or 28 degrees C 50 degrees F below the flash point or 274 degrees C 525 degrees F (maximum) whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Heating kettle shall be provided with automatic thermostatic control and an accurate thermometer. Kettle operators shall be in attendance at all times during the heating to ensure that the maximum temperature specified is not exceeded. An asphalt tanker shall be treated as a kettle.

3.7 BITUMEN APPLICATION

Asphalt shall be applied within 14 degrees C 25 degrees F below or above the EVT, or 204 degrees C, 400 degrees F, whichever is higher. Application temperatures shall be measured at the mop bucket or mechanical applicator. Bitumen at a temperature below the recommended temperature shall be returned to the kettle.

3.8 APPLICATIONS OF BASE SHEET

****

NOTE: Venting base sheet is required over gypsum and lightweight or insulating concrete, with or without insulation; otherwise, use non venting base sheet.

****

Base sheet shall be applied, shingle fashion, in a continuous operation, with side laps in accordance with manufacturer's printed instructions. End laps shall be not less than 150 mm 6 inches and staggered a minimum of 600 mm. 24 inches. Base sheets shall be applied at right angles to the slope (except on curved or steep deck) and laps shall face down the slope. [Venting base sheet shall be mechanically fastened in conformance with requirements of FM P7825c and the manufacturer's printed instructions.] [Non venting base sheet shall be applied in hot mopping of not less than 0.97 kg 20 pounds nor more than 1.7 kg 35 pounds of asphalt per square meter square and shall be embedded in the hot asphalt with a squeegee or broom to eliminate air pockets and assure complete adhesion. Operator shall avoid heavy application of squeegees to glass-fiber sheets.]

3.9 MODIFIED BITUMEN MEMBRANE APPLICATION

****

NOTE: Coordinate application method with manufacturers and local authority. APP requires torch application which will require approval of local command.

****

Membrane shall be [single ply] [two plies] [one or two plies,] [as indicated] [as recommended by the membrane manufacturer]. Each sheet in each ply shall be fully adhered to the underlying surface. Sheet edges shall lie flat, with no fishmouths or wrinkles. Installation shall begin at the low point of the roof and progress to the high point with each sheet installed shingle fashion. Each sheet shall be unrolled to provide 100 mm 4 inch side laps and 150 mm 6 inch end laps. End laps shall be staggered not less than 600 mm. 24 inches. Laps shall not coincide with laps of base layers except at lines of permanent termination. [Sheets shall be adhesive-bonded as specified in the manufacturer's approved written instructions.] [Sheets shall be embedded in hot solid-mopped asphalt, applied at a rate of 0.97 to 1.46 kg per square meter. 20 to 30 pounds per square. Hot asphalt shall flow out of all side and end laps. End laps shall be back-mopped.] [The underside of each sheet and the laps of the preceding roll shall be heated with a torch or electric heater and trowelled or rolled into place to provide a full adhesion of the membrane in a flow of modified bitumen of at least 10 mm 3/8 inch but not more than 25 mm 1 inch on all side and end laps.]

3.10 TERMINATIONS AT PERIMETERS

The modified bitumen membrane shall extend up abutting surface at least 100 mm 4 inches or 50 mm 2 inches above the top of the cant.

3.11 MECHANICAL FASTENING

****

NOTE: Mechanical fasteners will be required for venting base sheet regardless of slope. When roofing slope is greater than 42 mm/m (1/2 inch per foot), mechanical fasteners will be required for all base or membrane sheets.

****

Nails and fasteners for securing base or membrane sheet to wood nailers or deck shall be flush driven through flat metal disks of not less than 25 mm 1 inch diameter. Metal disks may be omitted where heads of fasteners are equivalent in size to the 25 mm 1 inch diameter disks. Screw fasteners with disks as specified by the membrane manufacturer shall be used on concrete or metal deck. Nails and fasteners shall be spaced to meet the wind uplift requirement and within the tolerances specified by the manufacturer. Penetration of nails and fasteners will not be permitted through the exposed surface of membrane.

3.12 PROTECTION OF APPLIED ROOFING

At end of day's work or whenever precipitation is imminent, the terminated edge of the roofing shall be sealed with two full width strips of roofing felt set in and coated with bituminous cement or hot mopped asphalt. One half-width of strips shall be extended up and over the finished roofing and the other half-width extended out and onto the bare roof deck or existing membrane. Sealing strips shall be removed before continuing installation

of roofing. To facilitate sealing, termination edges may be straightened with pieces of insulation board which shall be removed when work is resumed.

3.13 FLASHINGS

Flashings shall be provided over cants, in the angles formed at walls and other vertical surfaces, and where required to make the work watertight. Modified bitumen flashings shall be used, except where metal flashings are specified in other sections of the specifications.

3.14 WALKWAYS

****
NOTE: Location of walkways or traffic surfaces will be indicated on the drawings. If metal grid walkway is used for heavy traffic or to elevate walkway above ice and snow, it must have design loads and footings specified or shown to assure structural integrity and to protect the roof membrane.
****

Walkways shall be [mineral-surfaced asphalt planks,] [concrete pavers,] back-mopped and embedded in the flood coat prior to aggregate surfacing [loose-laid concrete pavers] [metal grid] [_____] and shall be located as indicated.

3.15 SURFACING

****
NOTE: Delete this paragraph if factory applied granules are used. Bare modified bitumen roofing should not be left unprotected except as recommended by the manufacturer. When used as a protected membrane, the membrane should not be surfaced.
****

After roofing membrane has been laid and flashings installed, the roof surface, except for cants, shall be flood coated uniformly with 2.9 kg60 pounds of hot asphalt per square meter, square, and while the asphalt is still hot, aggregate surfacing material shall be spread on the hot bitumen at a rate of 19.5 kg 400 pounds per square meter square for gravel or 14.6 kg 300 pounds per square meter square for other approved surfacing aggregate.

3.16 COATING APPLICATION

****
NOTE: Delete this paragraph if roofing is surfaced with aggregate, gravel or pavers. If factory applied roofing granules are used, the coating is optional, or as recommended by the manufacturer. Coating will extend the life of the modified bitumen, but will require maintenance. Coating is not needed for protected membrane roofing. Bare

modified bitumen roofing should not be left unprotected except as recommended by the manufacturer.

****

After roofing membrane has been laid and flashings installed, the roof surface, including cants, shall be coated with an aluminum coating as recommended by the membrane manufacturer.

3.17 FIRE WATCH

****

NOTE: This requirement shall be retained when membrane or flashing is torch applied.

****

Fire watch shall be provided continuously during and for at least 1 hour following torch application. At least two 9.46 liter 2-1/2 gallon containers of water and two 6.8 kg 15 pound carbon dioxide extinguishers shall be available during the fire watch. When work is interrupted, or at the end of a section of roofing, and at end of each day's work, areas which had been subjected to torch applications shall be surveyed with an infra-red sensing device. Hot spots shall be cooled and re-surveyed. If a hot spot persists, the roof shall be cut open and any smoldering shall be extinguished before the foreman leaves the site.

3.18 INFRARED INSPECTION

****

NOTE: Delete this requirement for small jobs and at sites where nondestructive inspection equipment is not available.

IR inspection will add 22 to 54 cents per square meter (2 to 5 cents per square foot) of roofing (based on 1990 prices). IR inspection detects the temperature difference between wet and dry insulation; in dry climates consider requiring the Contractor to flood the roof to assure absence of leaks.

****

[Eight] [_____] months after completion of the roofing system, the [Government will] [Contractor shall] inspect the roof surface using infrared (IR) scanning as specified in ASTM C 1153. Where the IR inspection indicates wet insulation, moisture content of the insulation shall be determined at sample cuts (including a sample from a suspected dry area). Wet insulation shall be replaced where the moisture content by weight exceeds the following values: wood fiber: 30 percent; glass fiber or perlite: 25 percent; polyisocyanurate: 260 percent. Wet insulation, overlying roofing and sample-cut areas shall be replaced as directed.

3.19 INSPECTION

****

NOTE: When justified by the amount or criticality of the roofing involved, and similar requirements are not established for the Contractor Quality Control organization specified elsewhere, the following requirement will be added at the end of the Inspection paragraph: "i. A roofing technician responsible directly to the Contractor and experienced in the construction of modified bitumen roofing systems shall perform the inspection functions and be on the site whenever roofing operations are in progress."

****

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roofing with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Inspection shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of roofing workers; start and end time of various tasks; condition of substrate.

b. Verification of compliance of materials before, during, and after installation.

c. Inspection of condition of equipment and accuracy of thermometers and metering devices.

d. Inspection of flashings, cants and curbs.

e. Inspection of membrane placement, including edge envelopes, widths of starter sheets, laps, proper use of squeegee, and mechanical fastening.

f. Inspection of application of bitumen, aggregate, and walkways.

g. Inspection of embedment of aggregate for required weight and coverage.

h. Cutout sampling and analysis as directed.

-- End of Section --